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ABSTRACT

Studied was memory for visually and auditorily presented stimuli in 29 institutionalized, mantally handicapped children, 29 normal second and third graders, and 29 5- and 6-year-old children enrolled in a Head Start program. Lists of visually and auditorily presented stimuli were learned by the three subject groups. Results indicated that trials to criterion did not differ across conditions for the normal second and third graders, but in the retarded group and in the Head Start group, the visual condition was found to require fewer trials than the auditory. The results were interpreted in light of the view that the retardate's cognitive development parallels the normal child's cognitive development in sequence, but at a slower pace. (CB)

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A Study of Memory for Visually and Auditorally Presented Stimuli in Retarded and Normal Children

Walter Stolz and Clydette Sitton

Austin State School

Austin, Texas

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Summary

Lists of visually and auditorily presented stimuli were learned by 29 institutionalized retardates, by normal children of approximately the same average MA, and by normal children equated with the retardates for performance in the visual condition. Trials to criterion did not differ across conditions for the MA-equated normals, but, in the other two groups, the visual condition required fewer trials than the auditory. These results are interpreted as being consistant with the view that the retardate's cognitive development is similar in sequence to that of the normal child's but slower in rate.

Introduction

Within the context of recent theorizing on the nature of mental retardation (cf. Zigler 1969) increasing stress has been laid on comparing the developing familial retardate with the normally developing child. The present study seeks to do this in one important area of cognitive development, memory. In particular, since our interest is specifically with the acquisition of language, we explore a suggestion made by Carroll (1967) that retardates may have an unusual amount of difficulty storing into their memory and retrieving from it information originally received auditorily. It is reasonable to assume that if one cannot efficiently remember and recall auditory material, particularly verbal material, then cognitive behavior will be impaired over a relatively wide range of everyday tasks. In fact, Katz and Deutsch (1964) found that "retarded" readers (of apparently normal overall intelligence) tended to do worse on auditory memory tasks than on visual memory tasks, while normal readers did not show this difference.

The normal development of "auditory memory"--that is, the ability to store and recall information presented auditorily--as compared to the development of "visual memory" (the ability to store and recall visually presented material) apparently has not been explored in any systematic way. In several early studies (Kirkpatrick, 1894, Worchester, 1925; and Young, 1936) the general

finding was that auditory memory was superior to visual memory in young children and in older children who were poor readers. Unfortunately these studies used printed words as visual stimuli, so the most parsimonious explanation of them would seem to be that people cannot remember printed words that they cannot read.

From an intuitive point of view, however, just the opposite might be predicted; that is, that young children should have better developed visual memory than auditory memory. This would come from the consideration that very young children receive most of their information about the world in the visual mode, while the auditory channel only becomes crucial to the child's information processing abilities as language becomes more and more important. For example, the overall development of deaf children progresses relatively normal for the first year or two; and, of course, they rely exclusively on the visual mode for information intake. It is only later, as they fail to develop language, that they become more and more severely handicapped in the hearing world.

To show the apparent dominance of the visual mode in a young child's information processing capabilities, one can easily rig a situation in which the child receives two contradictory imperatives, one visually and one auditorily, and see which one he follows. While we do not know of systematic experimentation along this line, our informal work with normal two and three year olds indicates that they will follow the visually received command more often than the auditorily received one. In any case, the literature seems not to contain any direct investigations of the relative dominance of various modalities in receiving and storing and recalling of information in children.

The present experiment was a step in that direction, with a particular focus on the comparison of normal and retarded children. The memory task chosen was to learn and recall a list of eight items. Each stimulus was either the name of a common object (spoken by the experimenter) or a simple line drawing of that object displayed on a card. Recall was always by pronouncing the name of the object.

The experimental design had each subject (S) serving in an "auditory" condition and in a "visual" condition. According to Carroll's suggestion, an interaction would be predicted between mode of stimulus presentation (auditory or visual) and type of child (normal or retarded), with the retardates doing differentially less well on the auditory task than the normal children.

Method

Subjects. Three groups of subjects were tested:

(a) Twenty-nine institutionalized mentally retarded Ss were tested, with an IQ range of 47 to 75 (mean= 63.2). Their chronological ages ranged from 10 to 14 years (mean=12.5). Mental ages ranged from 6.3 to 10.5 (mean=7.8). None displayed obvious sensory impairment and most displayed global retardation probably of the familial type. All were residents at the Austin State School.

(b) A group of 29 normal children enrolled in the second and third grades of a public school in the Austin Independent School District was also tested. IQ scores were not available for these Ss; however, they came from a lower-middle class section of the district and were making "average" progress in their school work. Thus, their mean chronological age, 8.1, can be taken as a rough estimate of their mental age, roughly equivalent to the mean mental age of the retarded group.

(c) A second normal group was used, this time roughly equating their performance on the visual task with that of the retardates. The children were 29 five and six year old children currently enrolled in an Austin Head Start class.

Procedure. The memory test consisted of eight item lists presented either auditorily or visually. In the visual condition, simple line drawings of common objects were used. These had been previously shown to be easily identifiable by first grade children (Katz and Deutsch, 1964). In the auditory condition the nouns refering to these objects (all monosyllabic and of high frequency) were presented. The lists used are indicated in Table 1.

Insert Table 1 about here

Each S was tested individually and served in the auditory and visual conditions in a single session. In each condition stimuli were presented at a rate of one every two seconds, with no rehearsal response permitted from the S. Immediately after all eight items had been presented S was asked to recall, in verbal form and in any order, as many of the items as possible. Criterion performance was set at one perfect repetition of the list or 15 trials.

The specific list presented in each modality to each S and the order of administration of the two conditions were counterbalanced across Ss.

Results

A summary of the data analysis is given in Tables 2 and 3. Using trials to criterion as the dependent variable, the public school children appeared much better on both tasks than either the retardates or the headstart children. Within the public school group, there was no reliable difference between the auditory and visual conditions ($t=0.85$, $p<0.20$), but a slight tendency toward finding the visual task easier.

The headstart group performed slightly better, but not reliably so, than did the retardates in both conditions. Both of these groups, however, showed a reliable difference between the two conditions ($t=2.40$, $p<0.01$; $t=2.00$, $p<.05$ respectively) with the visual condition being the easier.

Discussion

Looking first at the results of the retarded Ss, Carroll's hypothesis that they are deficient in auditory memory capacity would seem to be substantiated, especially in view of no difference between conditions in the public school group.

The next question to ask, of course, is about the reason for this deficit. Two major alternatives suggest themselves: One would be the "defect" hypothesis--that retardates have a peculiar deficit, relative to normal children, with respect to auditory memory. The deficit would be characterized as a global facet of the retardation syndrome per se and would not particularly be a function of chronological age, mental age, etc. The other alternative the "developmental" explanation, would be to assume that the observed deficit is a function of a certain stage of normal cognitive development and that the apparent difference between the public school normals and the retardates is due to the retardates being at an earlier stage of development than their counterparts. Thus, under this explanation we would expect to find some normal children at some stage of development displaying the same auditory deficit (or visual dominance, if you prefer) as the retardates. The headstart group was tested as an attempt to explore this latter line of reasoning.

The group means in Table 2 show that the normal children, selected

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Insert Table 2 about here

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to control for mental age, performed much better than did the retardates, thus indicating that on this particular task, mental age

alone is not a good predictor of performance. The headstart group, which had an estimated mental age (no IQ scores were available on these children) of less than six years, performed at approximately the same level on the visual task as did the retardates--therefore, it would seem to be an appropriate group to test the alternative explanations offered above. Their results tend to support the developmental hypothesis since they showed a mean deficit on the auditory task very similar to that of the retardates. There are two properties of the headstart group that tend to mitigate any firm conclusions, however. First, it is not unlikely that some familial or other type of retardation--as yet undiagnosed--existed in the group. If this was the case, any pattern of behavior which looked like the behavior of retardates could be attributed to retardation, in fact, in the group. Second, a few members of the headstart group were native Spanish speakers, and, while any child who could not name the pictures in English was eliminated, this still could have affected the results.

The headstart population was originally picked as a comparison group for the institutionalized retardates because they had approximately the same socio-economic background as did the retardates; however, the factors of possible incipient retardation and bilingualism in this group point to the need for testing another sample of normal children drawn from different population. Our plan is to test upper-middle class Anglo kindergarten or nursery school children whose average performance on the visual task is about the same as that of the retardates. If these children also show the auditory deficit, this would be clearer support for the developmental explanation as being the most parsimonious.

One final characteristic of the data should be brought to the attention of the reader--that of the variability within the groups. In particular, Table 2 shows that the within group variation for the retardates was much higher than that for the normals. This seems to be a common finding when comparing any group of retardates with normals and we have no illuminating explanation of it other than to note that any such sample of retardates is likely to be very heterogeneous on a large number of dimensions.

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Table 1

Stimulus Lists Employed

List A	List B
ball	eye
fish	chair
hat	bell
clock	cup
shoe	car
key	bus
star	drum
door	flag

Table 2

Means and Standard Deviations (Trials to Criterion)

	Auditory		Visual	
	Mean	S.D.	Mean	S.D.
Retardates	9.9	10.9	7.5	8.9
Headstart (Visual Controls)	9.1	3.9	7.0	7.7
Public School Children (MA Controls)	5.3	3.2	4.7	5.4

Table 3

Summary of Analysis of Variances

Source	MS	df	F	p
Total	17.51	173		
Between	21.75	86		
Groups	209.52	2	12.1	.0001
(Within groups)	17.28	84		
Within	12.6	87		
Condition	117.5	1	10.3	.002
Groups x Condition	13.0	2	1.1	
(Within cell)	11.34	84		